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ABSTRACT

This manual is intended to assist pesticide applicators who are engaged in right-of-way pest control to meet the requirements of the Michigan Department of Agriculture for certification. While the majority of material in this guide pertains to vegetation management, the guide also addresses right-of-way insect and fungus control. An introduction with the explanation of right-of-way areas is presented. The seven sections included describe: (1) Right-of-way vegetation management; (2) Insect and fungus control; (3) Managing aquatic plants; (4) Sources of injury to non-target organisms; (5) Environmental considerations; (6) Sources of information and recommendations; and (7) Applicator responsibilities. Section one discusses types of plants, action of herbicides, types of herbicides, herbicide application techniques, application equipment, factors affecting chemical weed control, factors affecting foliage application, factors affecting soil applied herbicides, and weather factors affecting chemical weed control. A list of self-help questions is presented at the end of some sections. (HM)

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Right-of-Way Pest Control

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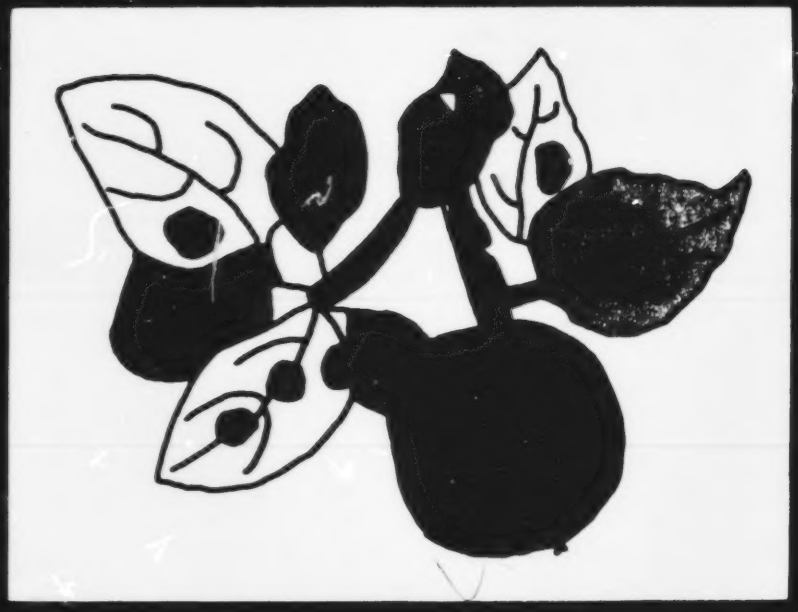
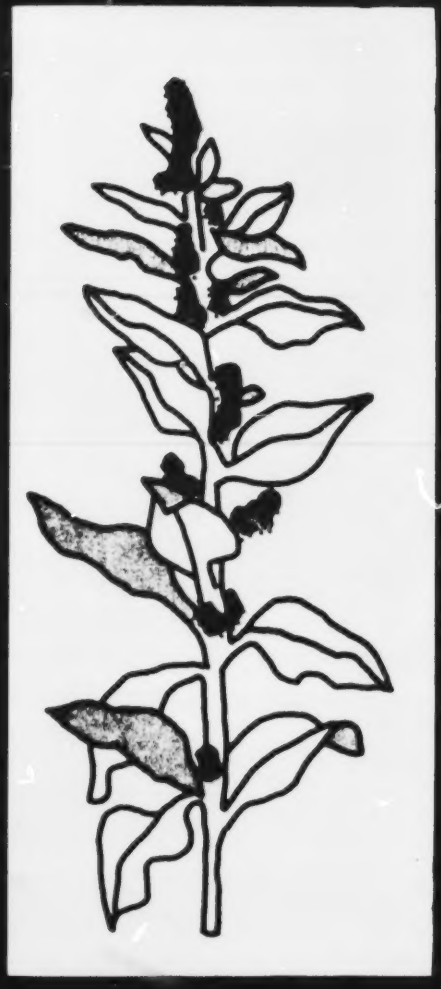
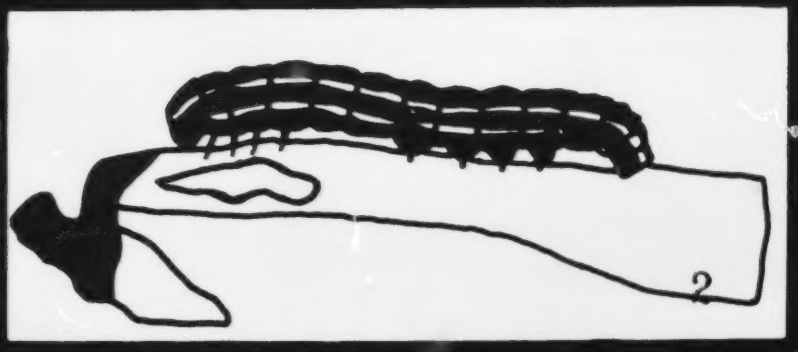
COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

SAFE, EFFECTIVE USE OF PESTICIDES
A MANUAL FOR COMMERCIAL APPLICATORS







SE 024 687

PREFACE

Federal regulations establish general and specific standards that you must meet before you can use or supervise the use of certain pesticides.

This guide contains basic information to help you meet the specific standards for applicators who are engaged in right-of-way pest control. While the majority of material in this guide pertains to vegetation management the guide also addresses right-of-way insect and fungus control.

A list of self-help questions and instructions for completing the questions are at the end of each section. If you encounter difficulties in using the manual, please consult your county agricultural extension agent or representative of the Michigan Department of Agriculture for assistance.

Some suggestions on studying the manual are:

1. Find a place and time for study where you will not be disturbed.
2. Read the entire manual through once to understand the scope and form of presentation of the material.
3. Then study one section of the manual at a time. You may want to underline important points in the manual or take written notes as you study the section.
4. Answer, in writing, the self-help questions at the end of each section. Instructions on how to use the self-help questions in your study are included with the questions. These questions are intended to aid you in your study and to help you evaluate your knowledge of the subject. As such, they are an important part of your study.
5. Reread the entire manual once again when you have finished studying all of its nine sections. Review with care any sections that you feel you do not fully understand.

This manual is intended to help you use pesticides effectively and safely when they are needed. We hope that you will review it occasionally to keep the material fresh in your mind.

INTRODUCTION

Rights-of-way are the areas involved in common transport. Included are:

- federal, state, county, and township highways and roads,
- utilities (including transformer stations and substations),
- pipelines (including pumping stations),
- public surface drainage ways,
- railroads,
- public airports, and
- bicycle, bridle, and snowmobile paths.

Plant growth and insects and diseases attracted to the plants along the right-of-way must be controlled to make sure that the right-of-way is:

- safe,
- usable,
- attractive,
- as inexpensive as possible to maintain, and
- not harmful to the environment of the surrounding area.

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R I G H T - O F - W A Y
V E G E T A T I O N M A N A G E M E N T

Before a vegetation management plan can be prescribed, the right-of-way (hereafter ROW) must first be surveyed to analyze the existing conditions. This survey should provide the following information:

- Species to be controlled,
- Special terrain features,
- sensitive areas requiring special attention,
- height and density of plant species to be controlled.

With this information and the goals of the management program in mind the manager can make the following determinations:

- type of herbicide to use,
- application technique,
- season of year for application,
- type of equipment needed,
- mixing rate and additives needed,
- need for mechanical control methods.

TYPES OF PLANTS

For the purpose of vegetation control with herbicides, plants are classed as follows:

Grass

Young grass seedlings have one leaf coming from the seed. Grass leaves are generally narrow, upright, and have parallel veins. Many grasses have fibrous root systems.

Broadleaf Plants

Broadleaf plants have two seed leaves. They generally have broad, net-veined leaves and tap roots or coarse root systems.

Woody Plants

Woody plants are those that form wood. They include brush, shrubs and trees.

Brush and shrubs are woody plants that have several stems and are less than 10 feet tall. When trees are present, brush or shrubs may be called understory.

Trees are woody plants which usually have a single stem (trunk) and are over 10 feet tall.

ACTION OF HERBICIDES

Translocated

These herbicides move through the entire plant system. They may build up in the plant's active growth centers. Most of these herbicides are selective. Some of them are most effective when applied to the plant foliage.

Other translocated herbicides must be applied to the soil. They are taken into the plant through the roots. These are called soil residual herbicides. The length of time the soil remains relatively weedfree depends upon the chemical used, amount applied, rainfall, soil type and the plant species in the treated area. Soil residual herbicides that are selective in some situations may be used nonselectively by increasing the rate of application.

Contact

These are herbicides that control weeds by direct contact with plant parts. They must be applied to the leaves. They are sometimes referred to as chemical "mowers." Good coverage is necessary since only the plant contacted is controlled. Most contact herbicides are nonselective.

- Spraying of visible plant foliage starts the action of a contact herbicide. A sprayer is usually used to apply herbicide after growth has started.
- Herbicide is taken into the plant leaves where it interferes with growth. The plant begins to curl, wither, and then turn brown.
- Plant growth above ground is eliminated. Some plants will not come back. However, some plants may regrow from roots. New plants may grow from seeds in the soil.

TYPES OF HERBICIDES

Selective

Selective herbicides kill certain kinds of plants but do not significantly injure others. An example of a true selective herbicide is the phenoxy type which can effectively kill broadleaf plants without significantly harming grasses. Other types of herbicides can be selective to individual plants or species of plants by using spot treatments or varying the application rates.

Nonselective

Nonselective herbicides should be used in areas where bare ground is needed. This type of control may be necessary around substations, pole yards, pumping stations, storage areas, guardrails, signposts, runway lights, parking areas, railroad yards, in railroad gallast, in pavement cracks, and on highway shoulders.

Your choice of herbicide and application should depend on the length of time you wish to control the vegetation. These herbicides normally fall in the following three groups:

Chemical mower herbicides: In general, these herbicides will kill the part of the plant that is treated. It is strictly a contact herbicide and does not kill the root system of perennial plants. Many of the species in the treatment area will sprout again from the roots and establish a vegetation cover within weeks or months.

Contact-translocated herbicides: In general, these herbicides kill all vegetation treated. The herbicide is translocated from the point of contact (foliage) into the roots and the entire plant usually is killed. This means no root sprouting, but after a time interval residues in the soil are degraded so germinating seed will grow. This type of herbicide often gives

two to three months control.

Bare ground herbicides: In general, these herbicides kill all vegetation treated but not on contact. The herbicide, after being sprayed evenly on the soil, is absorbed by the roots and translocated throughout the plant. The time lapse between treatment and control of vegetation depends on soil type, rainfall, plant species and rate of application. Bare ground herbicides can remain active in the soil for a year or more. Care must be exercised to apply these herbicides only in areas where residues will not create a problem; for example, where replanting is not a problem.

Combined herbicides: In some instances herbicides from two or more of the above groups are combined resulting in an application that shows the advantages of both groups. When a chemical mower and a bare ground herbicide are combined, immediate results are observed and control may last through two growing seasons.

Plant Growth Regulator

A vegetation cover is sometimes needed where mowing is not practical. In some of these places, you can use growth regulators to slow down plant growth. Because they generally do not create bare ground, erosion is not a problem. Use of these chemicals may cause an increase in undesirable plants, however, because not all plants are equally susceptible to them.

H E R B I C I D E

A P P L I C A T I O N T E C H N I Q U E S

Liquid and dry herbicide formulations can be applied by ground or air equipment. In ground applications, the applicator may ride on motorized equipment or may walk. Air application signifies use of aircraft, either helicopter or fixed-win airplane.

Ground-Applied Broadcast and Spot Application

Foliage treatment: This usually refers to spray or mist blower application. Systemic herbicides applied to foliage are absorbed through the leaves and then translocated to other parts of the treated plants, including growing points above and below the ground, i.e., shoots and roots. The herbicide then adversely affects plant growth processes and the plant may be injured or killed. Usually, better control is achieved when target plants are fully leafed out and growing well, under adequate soil moisture conditions. Foliage treatment may be accomplished by using high volume, complete coverage spraying or by using low volume application where complete foliage wetting is not obtained.

Spraying utility rights-of-way with high volume ground equipment may require up to 200 to 500 gallons of spray per acre where brush is dense. In contrast to mist blower or air application, the herbicide concentration is low, but generally the rate of herbicide per acre is fairly constant whether applied in high or low volume sprays.

Broadcast basal treatment: This broadcast application usually is made after most foliage has dropped off. The spray, often using oil as the herbicide carrier, is concentrated at the base of woody plants with some coverage of upper parts. The herbicide is absorbed directly through the bark and also by the roots if the spray gets into the soil. Sometimes

modified basal treatment is made when woody brush is in partial or full foliage.

Basal bark treatment: This is similar to broadcast basal treatment and refers to spot treatment of individual trees or brush clumps, applying a spray to the lower or base 12 to 15 inches and especially to the root collar area and exposed roots. Often fuel oil is used as a carrier of the herbicide and injury to grasses and other low growing plants can occur when directly sprayed. Application can be made at any time of the year, thus greatly extending the application season. Also, this control method minimizes the foliar "brown-out" which often characterizes summer foliage treatment.

Cut surface treatment: Stump treatment consists of spraying or painting the cut surfaces of freshly cut stumps and stubs, especially the cambial area just inside the bark. Also the bark is sprayed down to the ground. Normally, the entire stumps or stubs are treated. Sprouting is prevented and the stump dies.

Girdle or frill treatment: Employs a means of cutting into the bark (using an axe or other sharp implement) and then applying the herbicide to the cut areas. A single hack girdle (or frill) or overlapping axe cuts sprayed or painted with herbicide solution gets the herbicide directly into the active transport system of the tree, resulting in injury and kill.

Injection uses special tree injection equipment to apply herbicide solution in a measured amount as the bark is cut through. Usually, one to two milliliters of solution are injected at intervals of one to three inches around the tree trunk. This can be done at any season of the year. The effect is the same as with girdling or frilling.

Wound dressing is necessary in some situations. After pruning, larger cuts may be sprayed or painted with a protective material to prevent rotting of the wood and to promote healing. Some products contain a growth inhibitor to reduce sprouting. Most small cuts, if properly made, will heal naturally.

Pellet and granule application: Herbicides formulated as dry granules or pellets are applied by hand, by hand-operated spreaders, and by large mechanized equipment. Application is made on the ground under trees, brush. and weeds to be controlled. Either overall broadcast or spot treatment can be done. Herbicidal action is via root uptake. Such action obviously is

dependent on the herbicide getting to the roots through leaching by rain or irrigation. Application can be made at any time of year except when the soil is frozen. On frozen soil, surface runoff may be aggravated which can lead to off-target area injury problems.

Aerial Application

Aerial application of herbicides to utility rights-of-way is a highly specialized technique. In most areas helicopters are used because they are more maneuverable, achieve slower speeds for better applications, and need less landing space than do fixed-wing planes. In some situations, fixed-wing airplanes are used; for example, in treating extensive areas quickly such as rangeland or industrial sites. The length of spray boom in relation to the rotor or wingspread and the inclination of the nozzles are determining factors in properly targeting the spray and in lessening spray drift.

Although aerial spraying is largely a broadcast method of applying herbicides, it can be somewhat selective. Accurate spray placement or targeting can leave buffer strips at road crossings and around water areas, can side trim encroaching trees on right-of-way edges, and can leave an understory of desirable vegetation underneath a treated overstory of dense brush or trees.

Application Technique Summary

Application techniques are many and varied. In making an application, it is vital to know what one is doing and why. Some important considerations are the following:

1. Read, understand and follow label directions and precautions. These are primary prerequisites to effective and safe use of herbicides.
2. Inspect scheduled treatment areas prior to treatment to ascertain possible hazards of runoff or drift. Do not apply herbicides in areas near sensitive crops or other valuable plants unless there is no danger from drift or runoff.

3. Use the best application technique for each situation.

4. Be sure equipment is functioning properly.

5. Calibrate equipment carefully so that the applicator knows what volume is being applied.

6. Application must be limited to target areas. This implies adequate control of spray drift and soil surface runoff. Special care is required to keep herbicides from getting into streams and ponds, especially where there is a possibility that the water will be used for irrigation or drinking.

7. Good techniques and suitable equipment are available for proper application of herbicides. The human element often is a variable factor. When in doubt concerning the safety and/or propriety of an application, don't make it.

APPLICATION EQUIPMENT

Herbicides are applied by a wide variety of equipment from the ground and the air. It is important that spray equipment be thoroughly checked before the spray operation begins. Sprayer tanks should be cleaned out, motors checked and hoses and fittings checked for leaks.

Safety precautions in accordance with OSHA regulations shall be followed. When operating dusters, spreaders, and other pesticide application equipment, respirators may be required. See your OSHA Manual.

All spray operators shall receive instruction in vegetation identification, safety precautions and maintenance of equipment.

Ground Equipment

Hydraulic sprayers: Hydraulic sprayers are either power operated or manually operated by a hand pump.

Power-operated hydraulic sprayers have spray tank capacities that range from 50 gallons to 1,000 gallons. The pumps on these sprayers will deliver from 7 gallons per minute to 60 gallons per minute. By means of a pressure regulator, the pressure can be regulated from 25 pounds per square inch to 800 pounds per square inch, depending on the size of the pump. These sprayers are used for foliage treatment, basal bark treatment and for total or nonselective vegetation control.

Manually operated hydraulic sprayers are usually equipped with from 3 to 5 gallon tanks and pressure is applied to the tank by means of a manually operated hand pump. These sprayers are normally used for basal bark treatment, but they could be used for other methods of application.

Leaks in hydraulic sprayers should be repaired immediately and care should be exercised to avoid spills. After a hydraulic sprayer has been

used for a herbicide application, it should never be used to apply insecticides or fungicides on vegetation.

Mist blowers: Two types of mist blowers are used for herbicides. One is a large capacity mist blower mounted on a truck or other suitable transportation equipment. The second type is a backpack model carried by a person which has a small gasoline motor to propel the mist.

When using a mist blower, extreme care should be exercised as the particles are fine and subject to drift. Mist blowers can be used for foliage treatment and basal bark treatment.

Injectors: There are two types of tree injectors most commonly used. The first type is a long, hollow-handled injector. The hollow handle contains the chemical, and when the injector is thrown into the tree stem, a precise amount is injected into the cut by operating the pump handle. Some models inject a precise amount of chemical on impact automatically.

The second type of injector is known as the hypo-hatchet tree injector. This is a hatchet type that automatically injects a measured amount of chemical in the cut on impact. The chemical is carried in a one quart container worn on the operator's belt. A hose conveys the chemical from the container to the hatchet injector.

Dry spreaders and/or dusters: Most fertilizer spreaders can be used for applying dry herbicides. The broadcast type with a canvas bag or metal hopper is the most common. The size of opening can be adjusted for different rates of application. For large areas, a farm type fertilizer spreader is used.

Dusters come in various types and sizes. Manufacturer's recommendations should be followed. Some models of the backpack mist blower can also be used as a duster. OSHA regulations should be consulted for the wearing of goggles and/or respirators.

Aerosols: Aerosols are used for applying tree paints which may or may not contain growth regulators; however, some herbicides are packaged in aerosol containers.

Aerial Equipment

Aerial equipment consists of under-wing booms and electric driven pumps. These are carried on both fixed-wing planes and helicopters. This equipment is furnished by the owners of the aircraft and should be calibrated prior to use.

Helicopters also spread pellets by using special equipment especially designed for this purpose.

FACTORS AFFECTING CHEMICAL WEED CONTROL

All plants go through the following four stages of growth:

- seedling,
- vegetative,
- bud and flowering, and
- maturity.

Chemicals which control plants react differently in different plant species. The reactions can be generally categorized depending on the type of plant and the stage of growth the plant is in. For the purpose of this discussion, plants are divided into two large groups, herbaceous (have soft and succulent tissue) and woody. The herbaceous plants are further divided into the following groups: annuals, biennials and perennials.

Herbaceous Plants

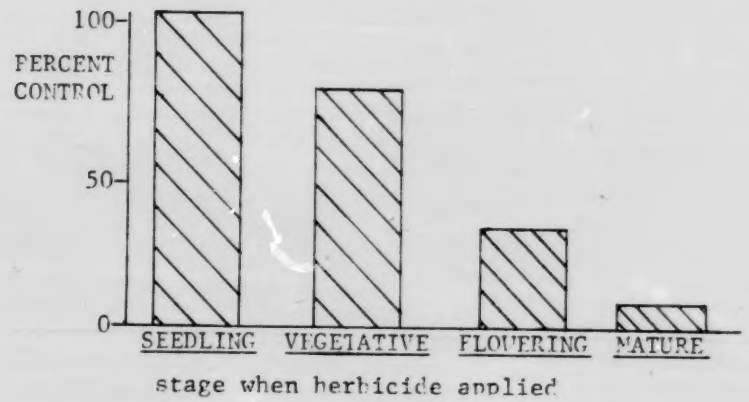
Annuals: Annuals last only one year or one growing season. They pass through four growth stages during this time.

The seedling stage of growth is the same for annual, biennial, and perennial plants. They are all started from seed. The plants are small and tender, so less energy is required for control at this state of growth than at any other stage. This is true whether mechanical or chemical control is used. Herbicides with foliar and/or soil activity are commonly used at this stage.

During the vegetative stage of growth, energy produced by the plant goes into the production of stems, leaves and roots. Control at this stage is still possible but sometimes more difficult than at the seedling stage of growth. Cultivation, mowing, and postemergence herbicides provide effective control.

When a plant changes from the vegetative to the flowering stage of growth, most of its energy goes into the production of seed. As plants reach this more mature stage, they are usually much harder to control by either mechanical or chemical methods.

Maturity and seed set of annuals completes the life cycle. Chemical control is usually not effective at this stage since there is little or no movement of materials in the plant. Once the seeds are mature, neither mechanical nor chemical controls usually harm them.



Biennials: Biennials go through the same stages as annuals but they take two years. The seedling and vegetative stages of growth occur the first year and the flowering and seed production the second year. Control is usually easier during the seedling stage.

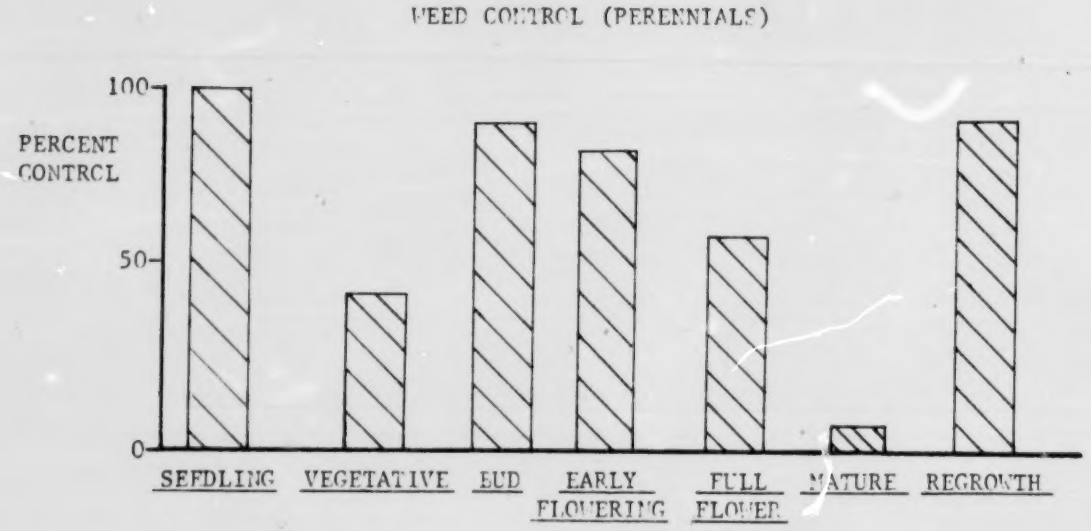
Perennials: Perennial plants continue to live from year to year and pass through the growth stages each year.

The seedling stage of growth is the same as for an annual or biennial.

When the plant is small, part of the energy used to produce stems and leaves comes from energy stored in the underground roots and stems. As the plant grows, and reaches the vegetative stage, more energy is produced in the plant leaves. Some of this is moved to the underground parts for growth and storage. Herbicides provide some control at this stage.

At the bud and flowering stage the plant's energy goes into the production of flowers and seeds. Food storage in the roots begins during these stages and continues through maturity. Chemical control is more effective at the bud stage (just before flowering).

Only the above-ground portions of mature perennials die each year. The underground roots and stems remain alive through the winter and send up new plant growth the next spring. Chemical control is usually ineffective at this stage.



Woody Plants

Woody plants go through the same four growth stages as other perennial plants. They do not die back to the ground during the winter, but many kinds lose their foliage. Woody plants can be controlled with herbicides at any time, but control is easiest when the plants are small. Foliar treatments can be used at any time when the woody plants have actively functioning leaves. They usually work best when the leaves are young.

FACTORS AFFECTING FOLIAGE APPLICATION

Location of Growth Points

Grass: The growing point of a seedling grass is protected below the soil surface. The plant will grow back if the contact herbicide or cultivation does not reach the growing point. Creeping perennial grasses may have buds below the soil surface.

Broadleaf: Seedling broadleaf weeds have an exposed growing point at the top of the young plant. They also have growing points in the leaf axils. Herbicides and cultivation can reach these points easily. The established perennial broadleaf plant is hard to control because of the many buds on the creeping roots and stems.

Woody: Many woody plants, either cut or uncut, will sprout from the base or roots.

Herbicide Entrance into the Plant

Leaf shape: Herbicide sprays tend to bounce off or run off plants with narrow vertical leaves. Broadleaf plants tend to hold the spray. If recommended on the label, add an adjuvant to increase spray retention.

Wall and cuticle: The herbicide must penetrate the leaf surface of the weeds. Thickness of wax and cuticle affect the entrance of a herbicide into a leaf. A leaf with a thin cuticle allows the spray solution good contact with the leaf surface under the wax layer. On a leaf with a thick waxy surface, the spray solution tends to stand up in droplets. The wax and cuticle are thinner on young plants. This is another reason for applying herbicides at the early growth stage.

Hairs: Hairs on the leaf surface tend to keep the spray solution from entering. The droplets stand up on the hairs and do not contact the leaf surface. Seedling weeds usually have fewer and shorter hairs. This is another reason for early control.

Species

Species vary in growth habits and susceptibility to herbicides.

Size

Seedling weeds are easier to control than established weeds. Smaller plants, regardless of their stage of growth, are usually easier to control than larger plants.

FACTORS AFFECTING SOIL-APPLIED HERBICIDES

Herbicide Characteristics

Soil Particle Tie-up: One of the properties of herbicides is magnetism. Some are not magnetic at all; others have strong megnetism. Those without a magnetic charge move down through the soil quickly. Others, with positive magnetic charges, tend to tie-up on the negative charge sites of soil particles.

Leaching: Leaching is related to herbicide characteristics and soil factors. Herbicides and soils vary from nonleachable to completely leachable.

Persistence: Persistence of a herbicide in the soil depends on herbicide characteristics, rate of application, soil texture, organic matter, precipitation, temperature, and surface flow. Herbicides can: (1) remain concentrated at the soil surface; (2) partially leach (diluting effect); or (3) move through the soil in a front, allowing new weeds to grow above.

Soil Type

Two factors affect the movement of herbicides that are applied to the soil: (1) soil texture—how much sand, silt, and clay the soil contains; and (2) organic matter in the soil.

Texture: Sand is coarse and does not have many charge sites. The magnet-like particles and herbicide molecules move down through the soil. The herbicide particle moves past the sand surface. It does not tie-up.

Silt has more sites than sand, but fewer than clay and organic matter.

Clay is fine and has many charge sites. The positively charged herbicide particle fits into the negatively charged slots on the clay particle. It is tied up and will not continue moving through the soil.

Organic matter: Organic matter has many more negative charge sites than even the finest soil particles. Not only herbicide particles, but also particles of other materials such as water, sodium, calcium, and ammonia are tied up on the organic matter.

WEATHER FACTORS AFFECTING CHEMICAL WEED CONTROL

Soil Moisture

Soil-applied herbicides must be in moist soil to be taken up by plant roots. This requires water in the form of precipitation or irrigation.

Temperature

Temperature generally does not affect weed control results. It may, however, affect the amount of time required for the herbicide to do its job. As temperature increases, the herbicide may work more quickly. In very cold weather, action of the herbicide may be slowed.

Humidity

A foliar-applied herbicide will enter the leaf more easily and rapidly at high humidity than at low humidity. At high humidity, the leaf is more tender and has a thinner layer of wax and cuticle.

Precipitation

If rainfall occurs soon after a foliar-applied herbicide treatment, it may decrease effectiveness. Rain increases soil moisture so soil-applied herbicides can be more readily absorbed by the weeds. But too much rain may move the herbicide too deep, past the zone where the weeds are. A hard rain may move surface-applied herbicides out of the target area. This is especially true if the soil surface is packed or sloping.

Time of Year

With a fall application of an herbicide, the target plant must survive three stresses:

1. the effects of the herbicide,
2. the effects of winter, and
3. the heavy demand for nutrients caused by the rapid growth period in the spring.

Fall treatments also may be safer for the environment, because many crops and other desirable plants have completed their growth.

Perennial weeds that have regrown after being controlled by chemical or mechanical methods should be treated in the fall. At that time, herbicides reach underground plant parts through the natural translocation activity of the plant. Before the first killing frost, nutrients move from the above-ground parts of the plants to be stored over winter in the underground parts. Underground parts must be killed to control these weeds.

Winter annuals also can be more easily controlled by a fall application of herbicide, because they are seedlings at that time.

Wind

Wind can also affect the plant. A hot, dry wind will cause:

- the openings on theplant surface to close,
- the leaf surface to become thicker, and
- the wax layer to harden.

These factors make it harder for herbicides to penetrate the leaves.

SELF-HELP QUESTIONS

Now that you havestudied the section, answer these questions. Write the answers with pencil without referring back to the text. When you are satisfied with your written answers, see if they are correct by checking them in the text. Erase your answer and write in the correct answer if your first answer is wrong.

1. Why should pests along a right-of-way be controlled?

2. What information should be obtained in planning pest control along a row?

3. What are the three types of plants that may be weeds along a row?

4. How can translocated herbicides be applied?

5. Are contact herbicides usually selective or nonselective?

6. Are grasses or broadleafed plants usually controlled with phenoxy type herbicides?

7. How long do bare ground herbicides remain active in the soil?

8. How many gallons of spray per acre should be applied to dense brush?

9. What is meant by a "basal bark treatment" of herbicide?

10. When can injection applications of herbicides be made?

11. How can pellet or granular formulations of herbicides be applied?

12. Why are helicopters rather than fixed-wing airplanes usually used to apply herbicides to ROW?

13. Where can you find informtion on safety precautions on the use of herbicides?

14. What is a common use for manually operated hydrolic sprayers?

15. Why are mist blowers especially subject to drift?

16. What are the four stages of plant growth?

17. What stage of growth of annual weeds is most sensitive to herbicides?

18. What stage ofgrowth of perennial plants is most sensitive to herbicides?

19. Where is the growing point of grasses located?

20. How does a waxy cuticle of a leaf affect the spray solution of a herbicide?

21. Do sandy soils tie-up soil herbicides?

22. Should soils be moist or dry when soil herbicides are applied?

23. What effect does a hard rain have on surface applied soil herbicides?

24. Why are fall-applied herbicides desirable for control of perennial weeds?

25. How does wind affect herbicide action?

INSECT AND FUNGUS CONTROL

At one time the primary goal of the ROW vegetation manager was to maintain a grassy swath free from broadleafed weeds, brush, and trees. With todays environmental concern, managers are now allowing many plant species, such as wild flowers and low-growing shrubs, to encroach on the ROW. In many instances, ornamental plants are even planted on the ROW especially around substations and storage yards.

These new developments added to items such as treating poles for insects and fungus make it necessary that the ROW pest control applicator have basic knowledge of these activities.

INSECT CONTROL

Insects can severely damage or destroy ornamental plants. Insects damage plants in many ways—by defoliating branches, by sucking the life-giving sap, or by boring and invading the bark and wood.

To effectively identify an insect problem, it is necessary to periodically inspect ornamentals for insects and signs of their damage. In order to select a chemical to control these pests, it is necessary to determine how the insect should be attacked. Symptoms of insect problems are usually placed in four broad categories:

Chewing Insects

The presence of chewing insects is often apparent from an observation of a plant's leaves. Leaves which are skeletonized between the veins, or which have portions of the normal leaf or needles missing or complete defoliation of the plant are signs of the work of chewing insects. Most likely, this

damage will occur in the spring and early summer.

Sucking Insects

The presence of honey dew or sooty mold on leaf surfaces is a sign of the presence of aphids or plant lice—one of the sucking insects. A crusty, scaly appearance of an ornamental plant limb should be examined. Many times limbs will be completely encrusted with scale insects, which are sucking insects that spend most of their lives under their protective shells or scales.

Boring Insects

The presence of boring insects is usually denoted by a general decrease in plant vigor. A borer problem can be better identified by evidence of borer holes in the affected plant stem. Often a woody frass or "sawdust" appearance will occur in conjunction with the bore holes. Plants in poor health or under some form of stress will attract boring insects.

Soil Insects

A general decrease in a plant's vigor, evident by yellowing leaves, poor growth or dying branches, could be symptomatic of a soil insect problem. Lawns, row crops or even wild grasses are often attacked by insects living in the soil.

When a vegetation problem has been identified as caused by an insect infestation, it will be necessary to determine an approved control technique. The kind of insect causing the problem should be identified or at least an inspection of the vegetation should indicate how the insect is feeding. From this inspection, a control method can be planned. If the insect is a new one, the county Cooperative Extension Office in your county can offer advice and recommendations.

FUNGUS CONTROL

Fungus in Structures

Wood structures, such as utility poles, guard and sign posts, bridge structures, are exposed to infestation by wood-destroying fungus. Usually wood pole beams and structures have been initially treated with chemicals to prevent fungus invasion but after various lengths of time the initial treatments will lose their effectiveness and the wood must be retreated, usually in place. Treatment may consist of an external application of wood-preserving chemicals paying particular attention to the area from groundline to 14 inches below groundline. At this location moisture and temperature are optimum for fungus development. Since these chemicals are often very toxic, extreme care must be exercised in the application following the manufacturers directions in detail.

Fungus in Ornamentals

Fungus control on trees and ornamental shrubs is a common part of a ground maintenance program. The principal attempt of a grounds maintenance program is to prevent fungus problems by proper vegetation management techniques and applications of chemicals that prevent or inhibit fungus growth. However, when a plant is determined to have a fungus infection, the proper chemical and application technique must be decided upon. Here again, the Cooperative Extension Service is in a position to advise you as to the kinds of chemicals to be applied and the proper time to apply them.

MANAGING AQUATIC PLANTS

Aquatic weeds are plants that interfere with the use or performance of water areas. They may:

- make the area less attractive,
- interfere with recreation,
- obstruct the flow of water in ditches or canals, and
- harbor insects or rodents.

The first step in control is to identify the general problem. Then you must identify the specific species to be controlled. Cooperative Extension Service personnel, written material and herbicide manufacturer's representatives can help you.

The basic approaches to aquatic weed control are:

- design and construction of the water area,
- operation andmaintenance,
- mechanical control, and
- chemical control.

The best control method is that which gives sure, effective weed control while causing the least harm to other parts of the environment. The use of herbicides to control weeds in water areas is often very effective. Use the herbicide as the label directs.

As you analyze any aquatic weed problem, you must consider the biological and water use aspects.

BIOLOGICAL ASPECTS

1. Identify the problem species.
2. Identify other species present.
3. Determine the density and stage of growth of the weeds and how much area they cover.
4. Determine what species of fish are present.

WATER USE ASPECTS

1. Know the uses of the water in the treatment area.
2. Find out how long the water can be quarantined from each use.
3. Know how much water leaves the treatment area and what it will be used for.

SOURCES OF INJURY TO NONTARGET ORGANISMS

Nontarget plants or animals, either in the treated area or adjacent to it, can be injured in several ways by pesticide application. Proper choice of pesticide formulations, application equipment or technique of application can reduce or eliminate this injury. Certain organisms are highly susceptable to both spray drift and volatility and extreme caution must be exercised when spraying in their proximity. The following paragraph list some of the common causes of injury.

DRIFT

Drift of pesticide sprays is the actual movement of small droplets or particles of the spray solution or pesticide dust at the time of application. Small droplets drift farther than large droplets, so spray drift can be reduced by using equipment or techniques which produce particles which are less likely to drift.

To reduce the chances for drift:

- Use the lowest practical pressure.
- Leave an untreated edge.
- Angle nozzles toward the ground slightly behind the direction of travel.
- Use nozzles with the largest practical openings.
- Operate at low speed.
- Spray when the wind is low.
- Consider drift control additives.

RUNOFF-LEACHING

Runoff-leaching, which is explained earlier in this training manual, is often the cause of injury to nontarget organisms. Persistent herbicides, which are improperly applied, applied before a hard rain storm or applied on a steep slope, are often carried out of the target area and cause damage when taken up by nontarget plant material.

ENVIRONMENTAL CONSIDERATIONS

Environmental awarness has made the public more critical of right-of-way pest control. When objections are raised, the applicator must be prepared to answer questions promptly and conduct a complete investigation.

- Interview claimant.
- Prepare a written report.
- Collect soil and plant samples.

Promptness and fairness will promote good public relations.

ESTHETICS

Care should be taken to minimize undesirable appearances in highly exposed right-of-way areas. Brownout would probably be objectionable on tall and heavy brush, while small spotty brush might be treated with a summer foliage application without undue criticism.

Dormant, basal and stump, injection and dry (see Application Techniques) materials can be used according to label instructions without an abrupt visual change. Selective cutting, removal and immediate treatment is a very desirable as well as effective treatment. Allowing shield areas to remain untreated provides a good buffer zone.

HABITAT CHANGES

The use of herbicides to control woody plants may have a major impact on wildlife habitat. Often the brushy right-of-way is the most productive wildlife habitat in a given area. ROW managers should keep this in mind when they develop their programs to keep the habitat changes to a minimum.

SOURCES OF INFORMATION AND RECOMMENDATIONS

The contract applicator should keep abreast with the new developments in the herbicide industry. All federal, state and local laws and regulations must be followed. Following are some of the sources of information that are available.

- Chemical labels
- County Cooperative Extension Service
- Field demonstrations
- Chemical company sales staff
- Industry publications
- Seminars

APPLICATOR RESPONSIBILITIES

Following are some of the responsibilities which should be undertaken to assure a successful herbicide application.

TRAINING AND SUPERVISION OF SPRAY MEN

The most important single factor in the proper application of pesticides is the selection and training of the spray crew. A training school should be held before the start of each spray season to acquaint new men with materials and equipment and their correct use. This training will also serve as a refresher course for experienced employees.

MONITORING AND CHECKING APPLICATIONS

Foremen and supervisors should be with crews at all times or make regular inspections of mixing and application procedures. When supervisors are not with crews, they should be within easy reach of each crew. Supervisors must check application techniques and sprayer calibration regularly, not only for safe application, but to be sure of good results.

DISPOSAL OF CONTAINERS AND CLEAN UP OF EQUIPMENT

Methods for disposal of pesticide containers are now being included on pesticide labels. Each pesticide or type of container may have different instructions. These instructions must be observed. Pesticide containers must not be left at the spray site or discarded with general trash.

Equipment should be kept clean and neat on a regular clean-up schedule. Residues and wash water from clean-up should not be allowed to run off and contaminate bodies of water. Clean-up at the spray site or in a specially selected area is important. If domestic or wild animals are in the area, residues and wash water from toxic pesticides should be disposed of in a safe manner. Follow label instructions.

REPORTS AND RECORD KEEPING

Detailed records should be kept of each application so evaluations can be made and so accurate information will be available.

Records should include:

- areas treated and date,
- material and rate applied,
- environmental conditions,
- equipment and crew,
- evaluation of effectiveness,
- problems encountered, and
- damage claims.

COMPLAINTS AND CLAIMS

If complaints are made following a pesticide application, the foreman or supervisor should investigate as soon as the complaint is received. Make a record of the facts and call in competent help if it seems necessary. If animal injury or death is involved, examination by a veterinarian is usually justified. If property is damaged, determine the apparent cause and the extent of the damage. If adjustments are required, make sure they are fair and prompt.

PUBLIC RELATIONS

Clean and neat crew men and equipment help to convince the public that proper applications are being made. Crew members should avoid damaging private property and should be pleasant and informed in their contacts with the public.

SELF-HELP QUESTIONS

Now that you have studied the section, answer these questions. Write the answers with pencil without referring back to the text. When you are satisfied with your written answers, see if they are correct by checking them in the text. Erase your answer and write in the correct answer if your first answer is wrong:

1. Is the grassy swath free of herbs, brush, and trees always the goal of a ROW manager?

2. How do insects damage ROW vegetation?

3. What are some signs of the presence of sucking insects?

4. Are vigorous or weakened plants more subject to attack by boring insects?

5. Where can you obtaininformation on insect control?

6. Where are conditions optimum for fungus development on poles, posts, bridge structures, and the like?

7. What are the four basic approaches to management of aquatic plants?

8. What is meant by "drift" of a pesticide?

9. What type of herbicide is most subject to vaporization?

10. What type of habitat is the most productive for wildlife?

11. Where can you find information on the safe disposal of empty pesticide containers?

12. What points should be noted in records of pesticide applications?

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